CHAPTER 4
PRIMARY TREATMENT SYSTEMS AND APPURTENANCES

Technologies are available that can be used to modify the characteristics of wastewater discharged to a septic tank. Pretreatment can reduce the amount of lint and grease discharged in the wastewater, which can influence the maintenance requirements and/or performance of subsequent treatment processes. Lint filters and grease traps are considered in this section.

Items to improve the operation of septic tanks can include liners and effluent filters. Liners and sealants are used to improve the water tightness of existing and some new tanks. Effluent filters are used to limit the discharge of particulate solids to the soil adsorption system and improve the performance of subsequent treatment processes, particularly biological treatment processes.

Technologies discussed in this chapter include: (1) lint filters, (2) grease traps, (3) septic tanks, (4) septic tank additives, (5) septic tank outlet filters, and (6) septic tank liners.

4-1 Lint filters

Filtration of water discharged from greywater sources (i.e., washing machines, bathroom sinks, and bathing facilities) is a form of wastewater pre-treatment. Filtration of wastewater before release to the wastewater management system can eliminate non-biodegradable particulates (i.e., plastic clothes fibers, hair, and other particulate and fibrous materials) that can reduce the rate of sludge accumulation in septic tanks and can reduce the performance of soil adsorption systems due to soil clogging.

Operation and maintenance

Periodic removal and cleaning of the filter cartridge is needed, depending on frequency of clothes washing or alternate use. Filters need replacement every 1 to 3 years.

Cost

Basic unit cost between $150 and 200, and replacement filters are about $20.

4-1.1 Septic Protector™

14622 268th Ave.
Zimmerman, MN 55398
Phone (612) 856-3800
Fax (612) 856-3888
E jvonmeier@sherbtel.net
Web www.septicprotector.com
Model description
Mesh sizes of 160 μm (30 μm optional).

Figure 4-1
The Septic Protector connected to the outlet of a washing machine. (Adapted from Septic Protector, Inc.)

4.2 Grease traps (oil and grease interceptors)

Separation of oil and grease from wastewater can improve the performance of downstream treatment systems, such as a septic tank, aerobic treatment processes, and soil adsorption systems. Grease traps are typically installed in-line before a septic tank and are designed to temporarily retain and cool water, allowing time for grease and oil to separate from water. Baffles located inside the grease trap, retain the grease and oil that floats to the surface. The clarified wastewater is discharged to subsequent treatment processes.

Advantages
Grease traps can prevent the premature failure of onsite wastewater treatment systems. Best used for applications with high concentrations of oil and grease in wastewater, such as restaurants, bakeries, laundromats, and service stations.

Disadvantages
Grease traps need to be emptied or pumped out periodically. The use of emulsifiers or oils with high solubility may be difficult and costly to remove. Emulsifiers are often used with under-the-sink or in-kitchen type grease traps to minimize kitchen clean-up time and effort; however, emulsifiers may reduce the performance of downstream treatment systems and/or impair soil adsorption systems. During peak wastewater discharge, flow rate may exceed rated capacity and result in insufficient oil and grease removal. Inefficient grease traps should be emptied more often (i.e., 50 percent capacity) to avoid oil and grease carryover to subsequent wastewater management systems. Oil and grease should be separated from the wastewater stream before mixing with blackwater sources to improve downstream treatment processes. Regulations imposed on treatment sites capable of processing septage with high concentrations of grease and oil will increase the transportation and disposal costs.

Operation and maintenance
Periodic monitoring to check level of grease and oil accumulated in tank. Removal and management of accumulated grease and oil will be required periodically, typically, every 3 to 6 months, depending on the effectiveness of the grease trap and the amount of oil and grease in the wastewater. Cleaning of internal components may be needed for automated grease and oil removal systems.

Cost
The cost is a dependent on the level of sophistication. Some systems include automated grease and oil removal from the separation chamber and/or grease and oil level monitoring equipment. Systems may be installed below ground or near the wastewater source, such as under a sink. Cost range is typically between $2,000 and 7,000. Many manufacturers of septic tanks also manufacture grease and oil interception tanks. Effluent (outlet) filters have also been used to improve the performance of grease traps.

4-2.1 Atlas Systems Inc.
PO Box 747
Rockland, MA 02370
Phone (617) 878-0334

4-2.2 Big Dipper-Thermaco®
646 Greensboro St
Asheboro, NC 27203
Phone (336) 629-4651; (800) 633-4204
Fax (363) 626-5739
E info@thermaco.com
Web www.big-dipper.com
Model descriptions
In-kitchen type systems for grease and oil removal for flow rates from 20 to 150 gpm.

Figure 4-2
The Big Dipper grease and oil removal system from Thermaco. (Adapted from Thermaco.)

4-2.3 NCS

16207 Meridian East; PO Box 73399
Puyallup, WA 98373
Phone (253) 848-2371; (800) 444-2371
Fax (363) 626-5739
E paulm@nwscascade.com
Web www.nwcascade.com
Model descriptions

A typical NIBBLER system has a grease trap, surge tank, NIBBLER unit, and clarifier. NIBBLER grease tanks may be located in a remote area (not in-kitchen) and typically have an HRT of several days.

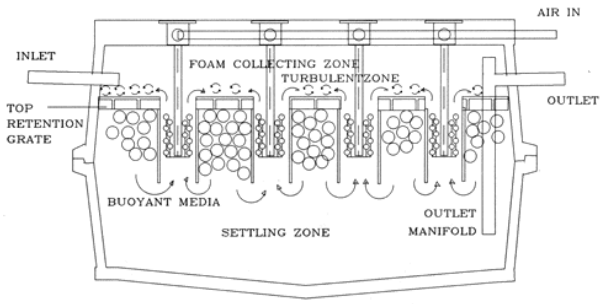

Figure 4-3
Side view of the NIBBLER system. (Adapted from NCS.)

4.3 Septic tanks

Settleable and floatable particulate materials need to be removed before release to a soil treatment system or secondary treatment process. Primary treatment efficiency is dependent on the primary treatment tank specifications and installation. The Imhoff tank is an alternative to the conventional septic tank, in which the sludge digestion and effluent clarification processes occur in separate regions. Septic tanks are available in concrete, plastic, and fiberglass. Plastic and fiberglass septic tanks lighter than concrete tanks and may require anti-floatation devices in high groundwater areas. Regardless of the material used for construction, all septic tanks should be evaluated to ensure that they are both **watertight** and **structurally sound**.

Operation and maintenance

The solids that accumulate in the septic tank need to be removed periodically, depending on the specific application (e.g., commercial or residential) and wastewater characteristics. Solids removal is conducted with a septic pumping and hauling truck and consists of removal of the settled sludge, liquid contents, and scum layer. The liquid and solid contents from the septic tank are typically hauled to a wastewater treatment facility for treatment.

Septic tanks that are regularly serviced and maintained can have the solids removed on an as needed basis (estimated 15 to 20 years), whereas septic tanks that are not regularly serviced may require more frequent solids removal (estimated 3 to 5 years). In addition, managed systems (i.e., on a regular monitoring schedule) may be eligible for other benefits including reduced drainfield size and less restrictive sizing and setback criteria due to the reduced possibility that the system will fail. Technologies that are being developed for measuring water level and solids depth will make remote monitoring more feasible.

Cost

Septic tanks cost about $1 per gallon of capacity for residential sized tanks. Solids removal is usually $150 to 400 per 1000 gallons. Complete septic systems, installed with a standard soil adsorption system, are typically in the range of $5,000 to 15,000 (cost may be considerably more in areas with poor soils).

Suppliers

Manufacturers of concrete septic tanks are available in most areas. Plastic and fiberglass septic tanks are lightweight and may be easier to install in some areas. Because of past failures, it is recommended that plastic tanks be water tested and inspected carefully for structural integrity.

4-3.1 Fiber Enterprises, Inc.

PO Box 8386
Red Bluff, CA 96080
Phone (530) 527-2196
Web www.fiber-enterprises.com

4-3.2 Mid-State Concrete Products

1625 East Donovan
Santa Maria, CA 93454
Phone (805) 928-2855
Fax (805) 928-2114
E midstate@midstateconcrete.com
Web www.midstateconcrete.com
Model description

800 to 1500 gallon precast septic tanks and grease traps, standard and traffic bearing models.

Figure 4-4

A precast concrete septic tank. (Adapted from Mid-State Concrete Products.)

4-3.3 Orenco Systems, Inc

814 Airway Ave.
Sutherlin, CA 97479
Phone (541) 459-4449
Fax (541) 459-2884
Web www.orenco.com
Model description

Assorted fiberglass tanks

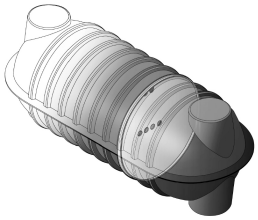

Figure 4-5

Illustration of a fiberglass septic tank showing baffle and flow through ports. (Adapted from Orenco Systems, Inc.)

4-3.2 Jensen Precast

5400 Raley Blvd
Sacramento, CA 95838
Phone (916) 991-8800;
(800) 843-9569
Fax (916) 991-8810
Web www.jensenprecast.com
Model description

Precast septic tanks and grease interceptors from 750 to 25,000 gal, also supply dosing tanks, pump vaults, and dosing siphons.

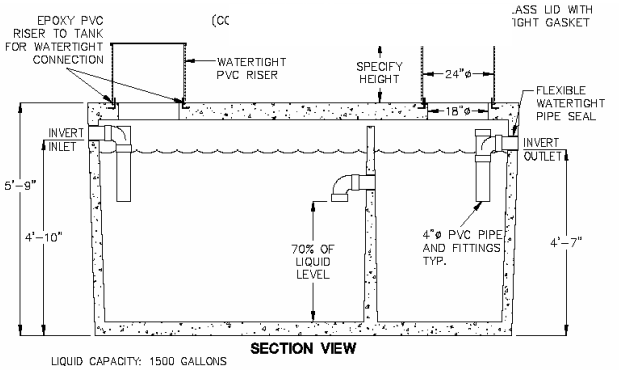

Figure 4-6

Diagram of typical precast concrete residential septic tank. (Adapted from Jensen Precast.)

4-3.3 Premier Tech Environment

7051 Meadow Lark Dr, Building 200, Suite 208
Birmingham, Al 35242
Phone (877) 295-5763
Fax (205) 408-8783
Web www.premiertech.com
Model description

PST-280	750 gal
PST-340	900 gal
PST-390	1030 gal
PST-500	1320 gal
PST-660	1745 gal

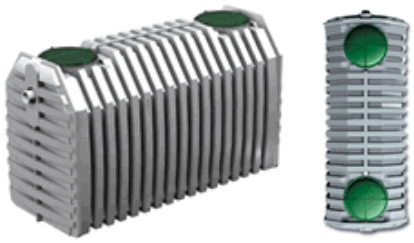

Figure 4-7

Views of the Premier Tech polyethelene septic tank. (Adapted from Premier Tech.)

4-3.4 Loomis Tank and Trough

44 N Canyon Way
Colfax, CA 95713
Phone (530) 346-7391
E info@loomistank.com
Web www.loomistank.com
Model description
Fiberglass and polyethylene septic tanks with sizes ranging from 300 gallons to 1,500 gallons.

Figure 4-8
Fiberglass and polyethylene septic tanks. (Adapted from Loomis Tank and Trough.)

4-3.5 Water Tanks.com

200 American Way; PO Box 340
Windsor, CA 95492
Phone (707) 535-1400; (877) 655-1100
Fax (707) 535-1450
E sales@watertanks.com
Web www.watertanks.com
Model description
300 to 1000 gallon polyethylene or fiberglass reinforced septic tanks.

4-4 Septic system additives

Approximately 1200 septic tank additives are currently available (National Small Flows Clearinghouse, 2002) and advertised as (1) removing deposits in household drains, (2) improving the operation of septic tanks, (3) reducing odors associated with septic systems, or (4) unclogging soil adsorption systems. Products fall into two broad categories (1) chemical (inorganic and organic) and (2) biological (bacteria or enzymes) supplements. Use of these products have advantages and disadvantages, although most studies have concluded that these products are not effective, and, in some cases, can be detrimental to septic systems.

Advantages

Products that are effective can provide a cost effective solution for improving the performance of onsite treatment systems. Products that are not effective for improving the operation of the septic system may increase homeowner's awareness of the septic system.

Disadvantages

Septic system additives may have a negative effect on the septic system, resulting in bacterial die off and/or reduced effluent quality. Caustic chemicals and organic solvents should never be added to septic systems. Controlled studies are needed to test manufacturer performance claims.

Operation and maintenance

Most manufacturers recommend adding products on a regular basis, for example, every other week, month, or year. In many cases, these products are used in an attempt to remedy a failing system and may be used as an indicator that the septic tank needs to be pumped or that the soil adsorption field is clogging.

Cost

The cost of septic tank additives depends on the manufacturer and the recommended usage. Typical costs range from ten to several hundred dollars per year.

References

National Small Flows Clearinghouse (2002) Septic Tank Additives, *Small Flow Quarterly*, Vol 3, No. 1.

U.S. EPA (2002) *Onsite Wastewater Treatment Systems Manual*, Office of Water; Office of Research and Development, U.S. Environmental Protection Agency, Washington DC.

Washington State Department of Health (2001) List of Approved On-Site Sewage System Additive Products, available at www.doh.wa.gov/ehp/ts/WW/Additives.pdf

4-5 Septic tank outlet (effluent) filters and pump vaults

The use of a screen effluent filter can significantly improve the effluent quality from primary treatment systems and are relatively inexpensive. Water inside of the septic tank or pump vault must pass through the outlet screen to exit the tank. Screens are available in a variety of mesh sizes, ranging from 0.125 in to 0.0156 in, some manufacturers offer filters with graded screen sizes. As wastewater flows through the screen, solids gradually blind the screen. Periodically the accumulated solids must be removed from the screen. Alarm systems may be used to alert the system owner that the water level in the septic tank is rising and that the filter needs to be cleaned. In many cases, the alarm can alert the system owner that the septic tank may need to be pumped as well.

Most manufacturers offer models that are located inside the septic tank (attached to the outlet) or systems that are located outside of the septic tank in a separate tank (i.e., pump vault). Most systems are also available with an integrated pump, for use with septic tank effluent pump (STEP) systems or other pressure distribution system. For larger flow rates, a manifold may be used to connect multiple effluent filters in parallel.

Advantages

Effluent screens are an effective way to reduce the solids being discharged to subsequent wastewater treatment processes. Clogging of the effluent filter can remind system owner that septic tank may need to be pumped out. Some systems provide a level of flow equalization. High water alarms can be used to alert system owner of pending filter clogging.

Disadvantages

Effluent screens require periodic maintenance to maintain effectiveness. Care needs to be exercised when cleaning filter to avoid discharging solids to subsequent wastewater management processes.

Operation and maintenance

Effluent filters will need to be cleaned periodically; the smaller screen openings and filter surface area will require more frequent cleaning. If an alarm system is in place, the alarm should be checked regularly to confirm its operation, and the effluent filter should be cleaned whenever the alarm is activated because of a high water level. Filter cleaning is generally provided by a septic tank servicing agency. The screened solids are typically washed back into the tank; the outlet should be blocked during cleaning to ensure that solids are not discharged. The effluent filter should always be cleaned during tank pumping, while the septic tank is empty.

Cost

The cost of effluent filters can range from around $50 for basic units that attach to the outlet inside of the septic tank, to $1,500 for advanced external units with additional features. Installation and maintenance will require an additional fee.

4-5.1 Bio-kinetic™ (BK 2000)

Norwalk Wastewater Equipment Company, Inc.
220 Republic St
Norwalk, OH 44857
Phone (419) 668-4471
Fax (419) 663-5440
Web www.norweco.com
Model description

Post septic tank effluent filtration systems that also provide flow equalization, rated for flow rates up to 2,000 gpd.

Model	Description
2000 X	Standard
2000 C	With chlorination
2000 CD	With dechlorination

Figure 4-9

The Bio-Kinetic wastewater management system from Norweco. (Adapted from Norwalk Wastewater Equipment Company, Inc.)

4-5.2 Biotube®

Orenco Systems Inc.
814 Airway Ave.
Sutherlin, OR 97479
Phone (541) 459-4449
(800) 348-9843
Fax (541) 459-2884
Web www.orenco.com
Model description

Filter screens with various size openings (typically 0.125 and 0.063 in), filter cartridges available in diameters of 4, 8, 12, and 15 in to accommodate a range of flowrates. May be used in new and retrofit applications as an outlet filter.

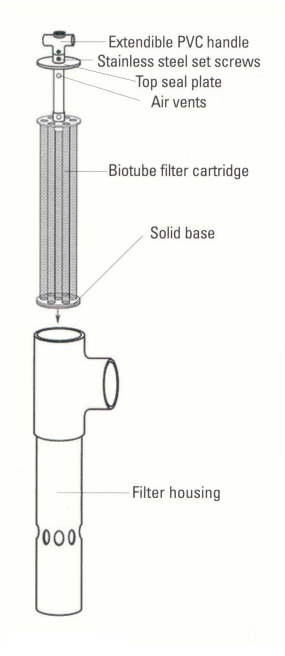

Figure 4-10

Diagram of the Biotube effluent filter (left), Biotube Jr. installed on the outlet of a septic tank, and larger Biotube filter installed on the outlet of a constructed wetland (right top). (Adapted from Orenco Systems, Inc.)

4-5.2 BIO WEIR FILTERS

11 College St.
Newnan, GA 30263
Phone (770) 301-6603
Fax (770) 251-2681

4-5.4 FLOWLINK MANUFACTURING COMPANY

7225 Pacific Ave., SE
Olympia, WA 98503
Phone (360) 491-2900; (800) 982-5393
Fax (360) 491-1990

4-5.5 Premier Tech Environment

7051 Meadow Lark Dr., Building 200, Suite 208
Birmingham, AL 35242
Phone (877) 295-5763
Fax (205) 408-8783
Web www.premiertech.com
Model description
EFT-080
Surface area = 1092 cm^2
Maximum flowrate = 3300 gpd

Figure 4-11

The Premier Tech effluent filter. (Adapted from Premier Tech.)

4-5.6 Presby Maze™

Presby Environmental
PO Box 617 Route 117
Sugar Hill, NH 03585
Phone (800) 473-5298
Fax (603) 823-8114
Web www.PresbyEnvironmental.com
Model description
A series of plastic mesh panels that trap suspended solids and improve the hydraulics of the septic tank.

Figure 4-12

The Presby Maze septic tank insert. (Adapted from Presby Environmental.)

4-5.7 Polylok, Inc.

173 Church St
Yalesville, CT 06492
Phone (800) 234-3119
Fax (203) 265-4941
Web www.polylok.com

Model description

The PL-122 is a modular outlet filter
1 PL-122 / 1600 GPD average flow
2 PL-122 / 3200 GPD average flow
3 PL-122 / 4800 GPD average flow
4 PL- 122 / 6400 GPD average flow
5 PL-122 / 8000 GPD average flow

Figure 4-13

The Polylok modular effluent filter can be customized for flowrate. (Adapted from Polylok, Inc.)

4-5.8 NCS

PO Box 73399
Puyallup, WA 98373
Phone (800) 444-2371
Fax (253) 840-0877
Web www.ncswastewater.com

Model description

NCS Stacked/Disk Screened Vaults utilizes graded filter disks stacked vertically in an upright vault. Gravity and integrated effluent pump models available.

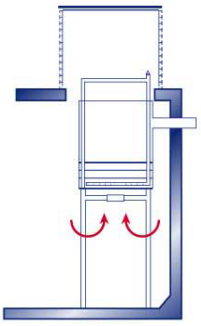

Figure 4-14

The NCS gravity effluent filter. (Adapted from NCS, Inc.)

4-5.9 saniTEE-THORSBY&BOWNE

3790 Honolulu Ave.
Eugene, OR 97404
Phone (503) 345-3001
Fax (503) 345-9354

4-5.10 SIM/TECH Filter

06598 Horton Bay North Rd.
Boyne City, MI 49712
Phone (231) 582-7327; (888) 999-3290
Fax (231) 582-7324
E simtech@freeway.net
Web www.gag-simtech.com

Model description

STF-100 effluent filter with 0.0625 in screen, rated at 83.8 gpm. Manifold used for connecting multiple units together for higher flow rates. Disposable filter sock available in 0.023, 0.006, and 00039 in sizes.

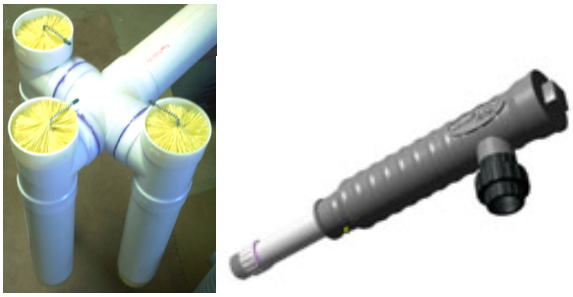

Figure 4-15

The Sim/Tech effluent filter. (Adapted from SIM/TECH.)

4-5.11 TREIT FILTERS COMPANY

3404 57th St. NW, Suite A
Gig Harbor, WA 98335
Phone (253) 853-5340
Fax (253) 853-4224
Model description
Model EF-1830
Model EF-1840
Model EF-2530
Model EF-2540

4-5.12 TUF-TITE DRAINAGE AND SEPTIC PRODUCTS

1125 Old Rand Rd.
Wauconda, IL 60084
Phone (708) 487-7000; (800) 382-7009
Fax (708) 487-7003

4-5.13 Zabel Environmental Technology

PO Box 1520
Crestwood, KY 40014
Phone (800) 221-5742
Web www.zabelzone.com
Model description

Series	Screen (in)	Flow rate (gpd)
A1800	0.0625	800
A100	0.0625	1200 to 6000
A300	0.0313	3000 to 6000
A600	0.0156	3000 to 6000

Fig 4-16

Zabel effluent filters (form left to right) Models A600, A1800 (internal), and A1800 (external). (Adapted from Zabel Environmental, Inc.)

4-5.14 Zoeller Pump Company

3649 Cane Run Rd.
Louisville, Kentucky 40211-1961
Phone (502) 778-2731
Fax (502) 774-3624
Web www.zoeller.com
Model description

Model	Screen (in)	Flow rate (gpd)
170-0016	0.0625	3240
170-0017	0.0313	3240
170-0058	0.0313	850
170-0078	0.0625	1000

Figure 4-17

Zoeller effluent filters for residential and commercial applications. (Adapted from Zoeller Pump Company.)

4-6 Septic tank liners/sealants

Liners and sealants are products that prevent the leakage of untreated sewage into the ground from a ruptured septic tank. Watertight septic tanks provide an additional barrier for groundwater protection.

4-6.1 Concrete Sealants, Inc.

8917 South Palmer Road, P. O. Box 176
New Carlisle OH 45344
Phone (937) 845-8776; (800) 332-7325
Fax (937) 845-3587
E hello@conseal.com
Web www.conseal.com
Model description
Butyl Resin Sealant formula, providing flexible, watertight joints for precast concrete structures

Fig 4-18

Butyl resin sealant applied to the rim of a precast tank. (Adapted from Concrete Sealants, Inc.)

4-6.2 Universal Liner™

Miller Environmental Products, Inc.
P.O. Box 334
East Bridgewater, MA 02333
Phone (508) 697-3710
Fax (508) 697-0606
Web www.millerenvironmentalinc.com
Model description
Interior and exterior PVC liner that can be cast-in-place or retrofit into an existing tank on the outside (excavated tank) or inside (non-excavated tank).

Figure 4-19

The Universal Liner completely seals septic tanks to prevent leakage. (Adapted from Miller Environmental Products, Inc.)